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ENTOMOLOGY.—*A new* Prorhinotermes *from Panama.* T. E. SNYDER, Bureau of Entomology.

J. Zetek and I. Molino of this Bureau, stationed at Ancon, Canal Zone, have recently collected a species in the genus *Prorhinotermes* Silvestri, which proves to be new. This new termite (*Prorhinotermes molinoi* Snyder) was found on Largo Remo Island, Canal Zone, on the Atlantic Coast. With the addition of this new species, the known termite fauna of Panama totals 30 species, representing 18 genera or sub-genera. The termites of Panama are of great biological interest; three families are well represented, but the Termitidae are the most numerous. Since the forming of Gatun Lake some species are apparently now confined to virgin islands in this lake.

Species of *Prorhinotermes* apparently are not subterranean in habit. In burrowing through wood the grain is followed; the hardest species of woods are riddled.

Prorhinotermes molinoi, new species.

Winged adult.—Head greyish-brown, darker than *P. simplex* Hagen; spectacle markings on epicranium, but slightly longer than broad, slightly broader posteriorly than anteriorly, with few scattered long hairs—3 transverse rows.

Fontanelle distinct, hyaline, sub-oval spot, on line at posterior of ocelli. Eyes black, nearly round, large, projecting, less than their diameter from lateral margin of head, a little less than twice their diameter from the posterior margin of the head. Ocelli hyaline, subelliptical, narrow, pointed at apex, nearly touching eyes, at oblique angle to eyes, nearly parallel to upper margin of antennal socket. Post-clypeus lighter colored than head, bilobed, projecting. Labrum lighter colored than head, arched, tongue-shaped, broader than long, broadest beyond central transverse line, with long hairs at apex.

Antennae yellow-brown, 17 or 18 segments, pubescent (long hairs); third segment is shorter and narrower than second or fourth segments; segments are wedge-shaped, but become broader and longer towards apex; last segment elongate and subelliptical.

Pronotum same color as head, broader than long, anterior margin slightly (concave) roundedly emarginate, sides roundedly taper to posterior margin, which is convex; with scattered long hairs on margins.

Legs yellow brown, fairly elongate, pubescent.

Wing scale plainly longer than the pronotum.

Wings hyaline, costal veins yellowish, base blackish, over twice as long as the abdomen. In forewing, there is no definite median vein, but the cubitus branches in the middle into two branches, the upper branch may be considered the median vein; it is above the cubitus, parallel to the subcostal vein, is unbranched, and nearly reaches the apex of the wing; the lower branch branches to the lower margin, there being from this and direct from the cubitus 17 branches or subbranches to the lower margin of the wing. In hind wing, the median is more distinct, and runs parallel and close to the cubitus until near the apex of the wing, where it branches to the subcosta; the cubitus reaches the apex of the wing, and has 17 branches or subbranches to the lower margin (Figs. 1 and 2).

Abdomen dorsum same color as pronotum, ventrally lighter colored; with row of long hairs at base of each tergite. Cerci fairly elongate.

Measurements:

Length of entire winged adult: 9.50 mm.
Length of entire dealated adult: 5.0–5.5 mm.
Length of head: 1.50 mm.
Length of pronotum: 0.77 mm.
Length of anterior wing: 7.50 mm.
Length of hind tibia: 1.17 mm.
Diameter of eye: 0.32 mm.
Width of head: 1.40 mm.
Width of pronotum: 1.10–1.20 mm.
Width of anterior wing: 2.30 mm.

Prorhinotermes molinoi Snyder has a larger head than *P. inopinatus* Silvestri of the Samoan Islands, and a larger pronotum and different wing venation than *P. simplex* Hagen of the West Indies and Southern Florida; it differs from *P. oceanicus* Wasmann of the Cocos Islands in that *P. oceanicus* has 22 segments to the antennae and differs in wing venation. Wasmann states in an appendix (p. 160)[1] that *P. oceanicus* is the winged adult of *Leucotermes insularis* Wasmann from the Cocos Islands. Holmgren,[2] however, considers *oceanicus* to be in the genus *Prorhinotermes*.

Soldier.—Head yellow-brown, slightly darker anteriorly, much broader posteriorly than anteriorly, with few scattered long hairs in several transverse rows; fontanelle hyaline spot (distinct) on line at center of eye spot. Eye spot hyaline, large, suboval. Labrum yellow-brown, elongate, rather narrow and rounded at tip, with long hairs at apex.

Mandibles dark reddish-brown, heavier and broader even to apex (less taper) than in *P. simplex* Hagen.

[1] 1903. WASMANN, E. *Über einige Termiten von Oceanien.* Zool. Jahrb. Band 17, Heft 1, Anhang 10: 139–164.

[2] 1910. HOLMGREN, N. *Termitienstudien.* Kungl. Sv. Vet. Akad. Handling., Band 46, no. 6: 73, *pl. 5, f. 11.*

Antennae yellow-brown (broken), pubescent; third segment subclavate, longer than fourth, but slightly shorter than second segment; segments wedge-shaped.

Maxillary palpi very long and slender; as long as mandibles.

Pronotum slightly darker than head, broader than long, broadest near anterior margin, slightly concave, sides roundedly taper to posterior margin, which is nearly a straight line.

Legs light yellow-brown, fairly elongate and slender, pubescent.

Abdomen yellow-brown, with row of long hairs at base of each tergite.

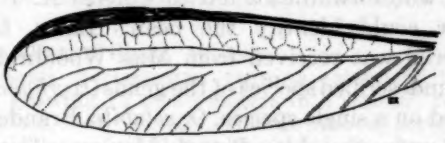


Fig. 1 fore wing

Fig. 2 hind wing

Measurements:

Length of entire soldier: 5.75–6.20 mm.
Length of head with mandibles: 2.90–3.00 mm.
Length of head without mandibles (to anterior): 1.90 mm.
Length of left mandible: 1.15–1.20 mm.
Length of pronotum: 0.70–0.80 mm.
Length of hind tibia: 1.20 mm.
Width of head (posteriorly where broadest): 1.60–1.65 mm.
Width of head (at anterior margin): 1.0–1.1 mm.
Width of pronotum: 1.20–1.30 mm.

Prorhinotermes molinoi Snyder has a larger head than *P. inopinatus* Silvestri and is longer than *P. simplex* Hagen.

Type locality. Largo Remo Island, Canal Zone, Panama, on the Atlantic Coast.

Described from a series of winged adults collected with soldiers and workers at the type locality by J. Zetek and I. Molino on August 31, 1923, in a hard, wet tree trunk on the ground. On the same day and on the same island winged adults, soldiers, and workers were found under the bark of a fallen coconut palm tree. I take pleasure in naming this termite after Dr. I. Molino, who has collected many interesting termites, and made valuable notes on their habits.

Type, *winged, male adult.*—Cat. No. 26756, U. S. N. M.; morphotype, soldier.

BOTANY—*The genus* Oxyrhynchus *Brandegee.* CHARLES V. PIPER, Bureau of Plant Industry.

In December, 1920, there were received from Miss Mary E. Woodbridge, State Department of Agriculture, Austin, Texas, seeds of a bean taken from plants grown near Austin by H. H. Parker, who reports that his original seeds were found in a lot of castor beans which the label on the bag indicated were imported from India. The seeds could not be identified, and so some of them were sent to Sir David Prain, at Kew, who forwarded a few to Colonel A. T. Gage, in Calcutta. Neither could identify the bean. Later, fairly complete botanical material was received from Miss Woodbridge. It proves to represent an undescribed species of the genus *Oxyrhynchus* Brandegee, which was based on a single species, *O. volubilis* Brandeg., collected by Purpus near Rascón, San Luis Potosí, Mexico. The specimens are in young flower.

The plant from Abaco and Cuba, described as *Dolichos insularis* Britton, also belongs to Oxyrhynchus.

On the basis of the more complete material the genus may be redescribed as follows:

OXYRHYNCHUS Brandegee

(*Leguminosae—Papilionacae—Phaseoleae—Phaseolinae*)

Twining herbs, perennial; leaves trifoliolate; stipules striate; flowers in axillary narrow raceme-like thyrses; bracts subulate, striate; bracteoles ovate; calyx bilabiate, campanulate, the rounded lobes subequal; standard reniform, broader than long, deeply emarginate, with two reflexed auricles at base; wings free, as long as the keel; keel broadly falcate, with narrowed acute beak, the two petals partly united, minutely ciliate; stamens diadelphous, the filaments glabrous, slightly enlarged at base; ovary linear, pubescent; style glabrous except near the apex, where bearded on each side with long hairs, and at tip, bearing similar hairs which partly surround the stigma; stigma ellipsoid-obovoid, attached on the dorsal side just below the middle; pods short-pedicelled, straight, cylindrical, beaked, terete or compressed, thin-walled, 2 or 3-seeded; seeds globose, each with a linear hilum extending over half the circumference of the seed, the hilum covered with a white caruncle; germination hypogeous.

Harms placed[1] *Oxyrhynchus* next to *Rhynchosia*, but it clearly belongs close to *Dolichos*, *Vigna*, and *Dysolobium*, as Dr. Harms points out in a recent letter.

[1] *Die Nat. Pflanzenf.* Erganzungsheft. 3: 149.

Apparently there are three species involved, certainly two, as the Austin plant is quite distinct from the others in its swollen pods. These species may be distinguished by the following key:

Pods turgid, circular in cross section; leaflets thin; inner layer of pod felt-like ..... 1. *O. alienus.*
Pods compressed and 2-edged.
Leaflets thin, tending to coriaceous, 4–6 cm. long, truncate at base; flowers 8 mm. long; inner layer of pod thin ..... 2. *O. volubilis.*
Leaflets thickish, membranous, 4–7 cm. long, the middle one often subcordate; flowers 10 mm. long; inner layer of pod felt-like. 3. *O. insularis.*

1. Oxyrhynchus alienus Piper, sp. nov.

Perennial; stems herbaceous, twining, slender, terete, sparsely strigillose, tall, growing 15 to 20 meters in a season; petioles about as long as the leaflets, very slender, sulcate above, strigillose especially at the enlarged base; stipules triangular-lanceolate, acute, striate, persistent, 2.5 mm. long; stipels subulate, 1 mm. long; petiolules somewhat fleshy, puberulent; leaflets membranous, ovate-triangular, the lateral ones oblique, nearly truncate at base, obtuse and apiculate at apex, 3-nerved at base, sparsely strigillose on both faces especially beneath, 6 to 8 cm. long, 4 cm. broad; peduncles terete, axillary, strigillose, the inflorescences exceeding the leaves; flowers about 6 in each of 10 to 20 lateral clusters in a narrow, rather dense, raceme-like thyrse, the pedicellar glands oblong and prominent; bracts subulate, striate, fugacious, 3 mm. long; bracteoles ovate, thin, ciliate, 1 mm. long; pedicels short, puberulent; calyx purple, open campanulate, 5 mm. long, 2-lipped, the subequal lobes as long as the teeth; upper lip 2-lobed, the lobes semicircular, minutely ciliate; lower lip 3-lobed, the broadly oblong lobes rounded at apex, minutely ciliate, the median one two-thirds as long as the others; corolla green, more or less tinged with dull purple; standard green, butterfly-shape, deeply notched, 10 mm. long, 15 mm. broad, slightly pubescent on the back especially near the base, bearing a deep depression below the middle, broadly cordate at base, the stipe only as long as the sinus, each basal lobe with a blunt inflexed auricle; wing dull violet, as long as the standard, oblong, obtuse, sparsely ciliate, a broad triangular tooth near the base on the upper edge, the stipe one-third as long as the blade, the edges somewhat inflexed; keel green with the beak violet, lunate, semicircular, rather broad, the two petals attached to below the middle, the beak rather acute; stamens included, diadelphous; filaments filiform, glabrous; anthers innate; pollen yellow; ovary linear, pubescent; style curved, glabrous to near the tip, bearing long lateral hairs on each side just below the stigma; stigma terminal, dark green, obovoid, attached on the dorsal side below the middle, surrounded by long stiff hairs arising from the sides of the style tip a short distance below the stigma; pods inflated, oblong-cylindric, thin-walled, acutely short-beaked, densely covered with short somewhat ferruginous hairs, the two sutures prominent, a faint ridge on each valve very close to the ventral suture, 5 cm. long, 2 cm. broad, 2 or 3-seeded; pods lined inside with a thick soft felt-like layer

of white tissue; seeds spherical, dark brown, shiny, 10 to 12 mm. in diameter, the hilum linear, extending over half the circumference of the seed and covered with a dense white caruncle.

Orginally sent by Miss Mary E. Woodbridge, from plants grown by H. H. Parker, Austin, Texas, from seeds found in castor beans supposed to be from India. Type in the United States National Herbarium, nos. 1,111,336 and 1,111,337.

In October, 1923, when seen by the writer, the plant was just beginning to bloom. The roots are thickish, about the size of a lead pencil, but no nodules were found on the original plant nor on several seedlings examined. The herbage is not ill-tasting and probably would be palatable to cattle. The vine is quite attractive and when in bloom showy. It is well worthy of culture as an ornamental vine.

2. OXYRHYNCHUS VOLUBILIS Brandeg. Univ. Cal. Publ. Bot. 4:271. 1912.

In addition to the type specimens collected by Purpus and represented in several herbaria, the plant was collected in mature fruit at Victoria, Tamaulipas, Mexico, November, 1830, by Berlandier (no. 3129), the specimen being in the Gray Herbarium. Another specimen from the same place was collected by Dr. E. Palmer (no. 265), February 1 to April 2, 1907, also in mature fruit. Dr. Palmer notes that it is called "frijol monilla," and that the seeds are used as food and also by children in lieu of marbles. Both the Berlandier and Palmer specimens seem identical with the Purpus plant, and the two localities are not far apart. The mature pods are compressed, 6.5 cm. long, 3 cm. broad, and 1 cm. thick, each containing three nearly globose seeds, 10 mm. long. Pringle's 11333, collected near Monterey, Nuevo Leon, is in young flower.

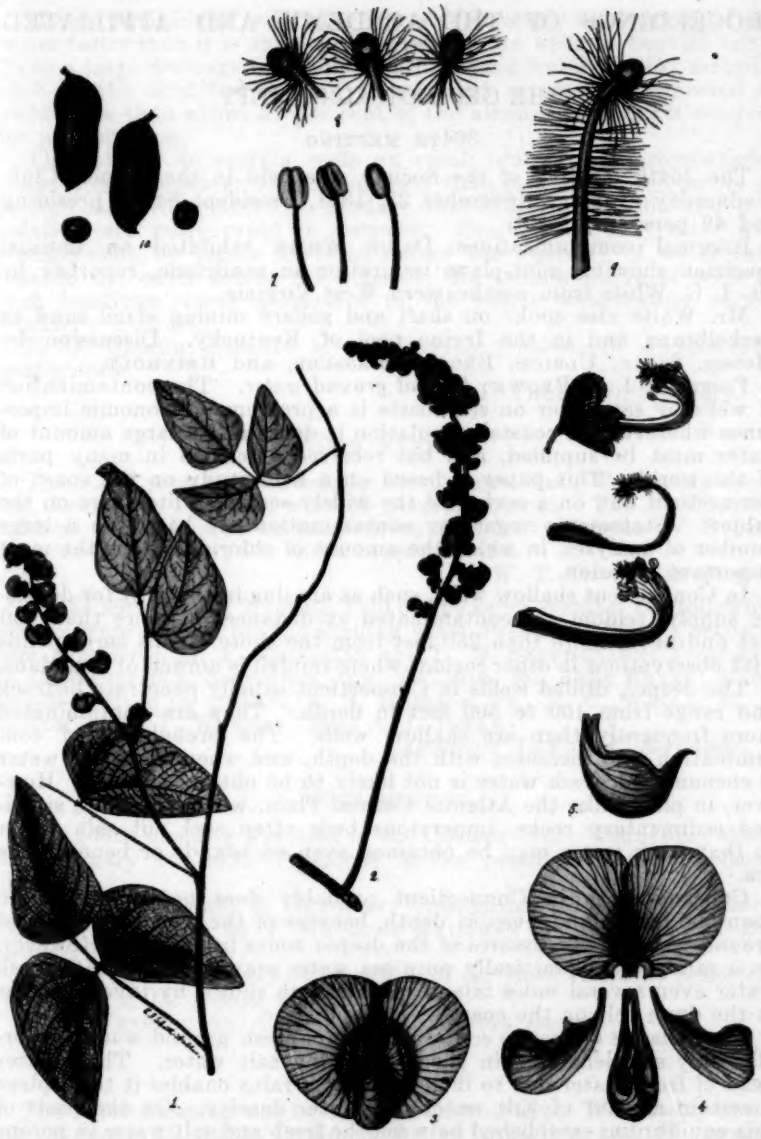
3. OXYRHYNCHUS INSULARIS (Britton) Piper.

Dolichos insularis Brittton in Brit. & Millspaugh, Bahama Flora 195. 1920.

This plant is known from the following specimens:

CUBA: Cayo Ballenato Grande, Camaguey, *Shafer* 1026, March 22, 1909 (type); La Gloria, Camaguey, *Shafer* 255, February 3, 1909.

ABACO: Old fields, Great Cistern, *Brace* 1757, Dec. 19, 1904.



OXYRHYNCHUS ALIENUS PIPER

1. Branch of plant, × ½; 2. Inflorescence, × ½; 3. Front view of flower, × 3; 4. Separate petals of flower, × 3; 5. Keel, lateral view, × 3; 6. Calyx, stamens, and pistil, × 3; 7. Anthers, much enlarged; 8 and 9. Tip of style and stigma, much enlarged; 10. Pods and seeds, × ½.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE GEOLOGICAL SOCIETY

364TH MEETING

The 364th meeting of the Society was held in the Cosmos Club, Wednesday evening, November 23, 1921, President STOSE presiding and 49 persons present.

Informal communications: DAVID WHITE exhibited an unusual specimen showing joint-plane induration in sandstone, reported by Dr. I. C. White from northeastern West Virginia.

Mr. White also spoke on shaft and gallery mining of oil sand at Pechelbronn and in the Irvine pool of Kentucky. Discussion by Messrs. STOSE, ULRICH, BROOKS, BASSLER, and REINHOLT.

Program: J. S. BROWN: *Coastal ground water.* The contamination of wells by sea water on sea coasts is a problem of economic importance wherever the coastal population is dense and a large amount of water must be supplied, and has received attention in many parts of the world. This paper is based on a field study on the coast of Connecticut and on a review of the widely scattered literature on the subject. Statements regarding contamination are based on a large number of analyses, in which the amount of chloride (Cl) is the most important criterion.

In Connecticut shallow wells, such as are dug in the drift for domestic supply, seldom are contaminated at distances of more than 100 feet and never more than 250 feet from the shore. This corresponds with observations in other regions where rainfall is normal or abundant.

The deeper, drilled wellls in Connecticut usually penetrate bedrock and range from 100 to 500 feet in depth. They are contaminated more frequently than are shallow wells. The probability of contamination also increases with the depth, and when once salt water is encountered, fresh water is not likely to be obtained below. However, in places like the Atlantic Coastal Plain, where there are stratified sedimentary rocks, impervious beds often seal out salt water so that fresh water may be obtained even on islands or beneath the sea.

Contamination in Connecticut probably does not extend more than 500 feet inland, even at depth, because of the poor circulation of ground water in the fissures of the deeper zones in bedrock. However, on a sandy coast practically pure sea water may occur beneath fresh water even several miles inland, as has been shown by investigations in the dune belt on the coast of Holland.

Most islands appear to contain bodies of fresh ground water, generally only as a lens or thin sheet overlying salt water. The greater head of fresh water due to increment from rains enables it to displace a certain amount of salt water of greater density. On the basis of this equilibrium established between the fresh and salt water in porous materials such as sand, it is possible sometimes to predict the depth at which salt water will be found when the height of the water table above sea level is known.

Heavy pumping of wells near the sea frequently exhausts the fresh water faster than it is supplied, and causes the wells to become salty. Even a large drainage basin underlain by good water-bearing material such as the stratified drift of Connecticut can not be expected to yield more than about 25 per cent of the amount of water it receives by precipitation.

The salinity in certain wells on small islands and promontories sometimes is much greater in summer than in winter. A number of factors seem to combine to produce this effect. Diffusion and percolation are more rapid in summer. Evaporation is greater and transpiration by plants tends to reduce the quantity of water that reaches the water table. As a result, the salinity curve of wells in such localities shows a relation to the yearly temperature curve. (*Author's abstract.*)

E. O. ULRICH: *Solution of some vexing problems in Appalachian stratigraphy.*

W. T. THOM, JR., *Secretary.*

365TH MEETING

The 365th meeting was held in the Cosmos Club, Wednesday evening, December 14, 1921, with 55 persons present. The Presidential Address was delivered by the retiring President, GEORGE W. STOSE: *Relation of faults to folds in the Appalachians.*

W. T. THOM, *Secretary.*

At the 29th Annual Meeting, held on the same evening, the following officers were elected for the ensuing year: *President,* WM. C. ALDEN; *Vice Presidents,* G. F. LOUGHLIN and L. W. STEPHENSON; *Treasurer,* G. R. MANSFIELD; *Secretaries,* WM. T. THOM, JR., KIRK BRYAN; *Members-at-Large of the Council,* J. B. REESIDE, JR., R. C. WELLS, M. I. GOLDMAN, E. T. WHERRY, Miss A. I. JONAS.

LAURENCE LAFORGE, *Secretary.*

366TH MEETING

The 366th meeting was held in the Cosmos Club, Wednesday evening, January 11, 1922, President ALDEN presiding and 45 persons present.

Program: HERBERT E. GREGORY: *Geographic outline of the Southern Pacific.* Presented by T. WAYLAND VAUGHAN in the absence of Dr. Gregory.

T. WAYLAND VAUGHAN: *Correlation of the post-Cretaceous geological formations of the Pacific region.*

H. S. WASHINGTON: *Chemistry of Hawaiian Lavas.*

367TH MEETING

The 367th meeting was held in the Cosmos Club, Wednesday evening, January 25, 1922, President ALDEN presiding and 48 persons present.

Program: Prof. P. P. GOUDKOFF: *New aspects on the geology of the principal ore-bearing provinces of Siberia.*

JOINT MEETING

A joint meeting of the Washington Academy of Sciences and the Geological Society of Washington was held in the assembly hall of the Cosmos Club, Thursday evening, February 2, 1922, President HUMPHREYS of the Academy presiding, and 74 persons present.

Program: Prof. H. A. BROUWER: *The major tectonic features of the Dutch East Indies.*

368TH MEETING

The 368th meeting was held in the Cosmos Club, Wednesday evening, February 20, 1922, President ALDEN presiding and 63 persons present.

Informal communication: KIRK BRYAN—*Examples of wind erosion in the Plateau country of Arizona.*

Program: C. E. SIEBENTHAL: *Fluorspar district of Jardin County, Illinois.*

FRANK L. HESS: *Uranium-bearing asphaltite sediments of Utah.*

H. D. MISER and C. S. ROSS: *Diamond-bearing peridotite in Arkansas.*

369TH MEETING

The 369th meeting was held in the Cosmos Club, Wednesday evening, March 8, 1922, President ALDEN presiding and 62 persons present.

Program: FRANK REEVES: *A distant peripheral zone of thrust faulting in flat-lying beds around the Bearpaw Mountain intrusion, Montana.*

The regionally flat-lying Cretaceous formations which encircle the Bearpaw Mountains in Montana are highly faulted. These faults apparently are confined to a peripheral zone approximately 20 miles wide, which may be separated from the mountains by an unfaulted belt 8 to 10 miles wide. The larger faults are 10 to 20 miles long and have throws ranging from 1,200 to 1,500 feet. In a rough way they form arcs of circles circumscribed about the mountains. The chief characteristics of these faults are that on the upthrown side along a belt one-half to 1 mile wide the strata are usually highly inclined away from the fault, while on the downthrown side they lie at their regionally horizontal position. Other interesting features are the occurrence of pivotal faults—i.e., faults in which the throw changes sides along the fault plane—and the presence of long, narrow, rectangular, and smaller triangular horsts.

As many of these faults pass laterally into steeply dipping limbs of anticlines and as parallel with them there are long, narrow unbroken anticlinal folds, some of which are overturned, it seems evident that the faulting and folding are contemporaneous, and consequently that all the faults are either thrust faults or faults of slight hade. The few fault planes observed by the speaker, who mapped a portion of the faulted belt on the southeastern side of the mountains in the summer of 1921, were inclined toward the upthrown side at angles from 45° to 70°. The pivotal faults can be considered as thrust faults produced by the faulting of anticlinal folds along their axes. At one end of such a fault one limb of the anticline is faulted down, on the other end the other limb is faulted down.

Apparently these faults and folds were produced as a result of horizontal compression and as the deformed zone is so closely associated with the Bearpaw Mountains, these compressive forces probably originated in crustal movements in the mountains. These mountains, however, being a circular area of uplift consisting of a cluster of extinct volcanos whose breccia tuffs and flows rest upon a slightly elevated floor of Cretaceous shale, offer no obvious explanation of the origin of these compressive forces.

It is here suggested that beneath these mountains, at a depth of a few thousand feet, there is a laccolith, and that the intrusion of this laccolith domed up the overlying beds to a height of about 3 miles, and that later, either as a result of a sag in the earth's crust, induced by the weight of the laccolith, or by the escape of the magma upward through volcanic vents, the whole laccolith or the upper surface was lowered nearly 3 miles. (Such an elevation and subsidence would be necessary to produce a crustal shortening across the faulted zone of 2,500 feet, which is the amount estimated for the part of the faulted zone that was studied by the speaker.)

If this subsidence occurred, it is thought that the strata overlying the laccolith would be under great horizontal compression, for they would probably have been lengthened by the solidification of lava intruded into the tensional fissures caused by the uplifts, and could not settle back to a lower position without buckling. It is possible that the intrusion of igneous dikes and sills into the strata overlying the laccolith would so metamorphose and reinforce the strata that they would not buckle in the center of the dome but would transmit the compressive stresses out to the less rigid strata surrounding the mountains, and produce there the peripheral zone of faults.

The presence of dikes, sills, and small volcanic necks cutting Cretaceous rocks out as far from the mountains as the faulted zone suggests that the laccolith extended out under the faulted area in sill-like form. If it had such an extension and was not solidified when the collapse occurred, it would furnish a surface on which the domed beds could flatten without the development of a great amount of friction. In transmitting these compressive stresses the Eagle and Judith River sandstones, and probably the Madison limestone, if the laccolith were intruded below it, acted as competent beds. It is thought that the associated Claggett and Colorado shales under pressure would flow and give a vertical component to the horizontal compression stresses, which would explain why the strata are bowed up so sharply along the fault planes and why there are so many horsts or upthrown blocks. This flow of shales can be observed in some places in the field where the 600 feet of Claggett shale has been entirely pinched out, leaving the Judith River formation resting upon the Eagle sandstones.

That other laccoliths in the same region have not had such a history may be due to the fact that as a result of deeper burial or greater viscosity there was no upward escape of magma, or more probably that because of the larger size of the Bearpaw laccolith it alone of all the laccoliths in the western United States exceeded the load that the earth's crust could support. In support of such an explanation it may be noted that the larger laccoliths of the world have centripetal dips. *(Author's abstract.)*

W. D. COLLINS: *Fallacies regarding mineral waters.* It is generally admitted that a number of mineral waters have therapeutic properties. Some of the literature on the subject is thoroughly reliable, but erroneous or misleading statements may be found in the writings of those not specialists in the subject. Such errors are particularly apparent in attempts to correlate the composition of the mineral matter dissolved in a water with the therapeutic properties of the water. These properties have been attributed to the presence of traces of lithium, bromide, iodide, radium, or like substances, because such traces have been shown in analyses of the waters, and because the substances themselves are known to produce certain physiological effects. Such an explanation ignores the fact that no one could drink in a day the quantity of water which would contain an ordinary therapeutic dose of the unusual constituents. Furthermore, the water of many public supplies contains traces of these constituents so that such an explanation implies that millions of people are taking the medicine in every drink of water. It is not uncommon to describe the therapeutic action of ordinary substances such as calcium carbonate and bicarbonate or sodium chloride in connection with analyses of waters which contain no more of these constituents than can be found in many public and private supplies. All the statements regarding therapeutic action of the substances may be true, but the implied connection between the presence of these common constituents and curative properties of the waters is misleading. (*Author's abstract.*)

P. V. ROUNDY: *Upward migration of oil along a fault plane in Oklahoma.*

370TH MEETING

The 370th meeting of the Society was held in the Cosmos Club, Wednesday evening, March 22, 1922, Vice-President LOUHGLIN presiding and 52 persons present.

Program: J. S. DILLER: *The surface fusion of recent lavas.* (Illustrated.) In the remarkably progressive paper by Drs. Arthur L. Day and E. S. Shepherd on *Water and volcanic activity*[1] the important part played by water in volcanic eruptions was clearly demonstrated. It was also shown by them that as a magma rose in a volcano in consequence of the gradual release of pressure, dissolved gases were set free in constantly increasing quantity as the surfce is approached, and, especially near the surface, reactions were set up among the gases that increased the temperature in some cases locally at least more than enough to offset the loss of heat by expansion and exposure. The lava lake of Kilauea, apparently, is regarded by Day and Shepherd, and also by Dr. E. T. Allen, as maintained in a molten condition by such reactions.

A remarkable case of the fusion of lava after it reached the surface occurred in Salvador in connection with an eruption of basalt from the crater of El Pinar, June 7, 1917. Specimens of the lava were sent by Dr. S. Calderón, of San Salvador, to the U. S. Department of Agriculture. Dr. Calderón says, "The samples I am sending you were collected on the upper surface of the ground, in the pockets

[1] Bull. Geol. Soc. Amer. **24**: 573. 1913, reprinted in Ann. Rep. Smithsonian Inst. 1913 275.

of scoria formed by the escape of gases, being found on all very steep slopes where the current of lava formed casades." It appears that the lava flow in passing over the cascade was much broken and torn forming pockets into which the gases escaping from the lava collected and apparently mixed with the confined air. The reaction of the gases produced so much heat that the lava exposed on the inner surfaces of the pockets was fused. The fused basalt formed icicle-shaped bodies hanging from the roof from which the molten basalt dropped off to the floor or ran down the sides of the pocket. Although the lava in this case is basalt and fuses more easily than most other lavas the amount fused in the pockets appears to have been relatively small.

A similar phenomenon has been observed in connection with a late eruption of Lassen Peak. The lava is not basalt but dacite. About the volcanic vent from which the dacite was erupted May 19, 1915, on the joint plane surfaces in the new lava there are local patches of once molten material which appear to have been formed during the great explosive eruption of May 22, by rising hot gases escaping from beneath the surface along fractures into small pockets at the surface.

371ST MEETING

The 371st meeting was held in the Cosmos Club Wednesday evening, April 12, 1922, President ALDEN presiding and 53 persons present.

Program: M. N. BRAMLETTE: *The origin of the chert in the Oneota Dolomite.* The Oneota Dolomite of the basal Ordovician in Wisconsin contains much associated chert as nodules and lens-like masses parallel to the bedding-planes. This chert is a replacement of the carbonate rock, as shown by the exact similarity of micro-structure in the oolitic dolomite and oolitic chert, with a contact between the two showing all stages of the change, individual ooliths being partly of carbonate and partly of chert. Also, "cryptozoan" reefs, in which the chert occurs, show the organic micro-structure preserved by the replacing chert.

Evidence of the time of replacement is not conclusive. It seems to have been effected by marine waters as a syngenetic process; first, because the distribution is more suggestive of such a process, and secondly, because silicification was antecedent to dolomitization, as evidenced by the destruction of fossils by the latter process and their preservation where silicified before such dolomitization. Dolomitization of formations similar to the Oneota Dolomite is generally accepted as a syngenetic process effected by sea-waters. (*Author's abstract.*)

C. E. VAN ORSTRAND: *Deep earth temperatures.* (Illustrated.)

ARTHUR L. DAY and E. T. ALLEN: *The hot springs of the Lassen National Park.* (Illustrated.) These springs are regarded as volcanic in origin. The heat is doubtless volcanic as well as the gases which issue from the springs. The same may be said of a portion of the water, but the conditions prevailing satisfy none of the criteria which have been proposed for "juvenile" springs; most of the water is therefore probably meteoric.

The substances dissolved and precipitated in the springs are interpreted as decomposition products of the lavas of the region by free sulphuric acid which occurs in many of the waters. These substances

are opal, "kaolin," alunite, pyrite, and the sulphates of the common rock bases. The sulphuric acid is probably derived from the volcanic gases, hydrogen sulphide or sulphur.

Though most of the springs contain free acid a few are slightly alkaline. The alkaline condition logically represents a later stage of chemical reaction between the rock and dilute acid. These springs do not necessarily belong to a subsequent period; they may rather be the product of conditions locally favorable to more complete chemical action.

Hot acid springs of volcanic origin on chemical grounds are classified as a stage of volcanic activity that follows fumaroles and precedes alkaline springs. (*Author's abstract.*)

R. S. Bassler: *Oscillation of the Central Basin of Tennessee in Ordovician time and its economic bearing.* (Illustrated.) The Carters, Lowville, and Kimmswick formations, of Black River age; the Curdsville, Hermitage, Bigby, Cannon, and Catheys formations, of Mohawkian age; and the Leipers formation, of Cincinnatian age, all rather easily distinguished faunally and lithologically, prove, in the course of extensive mapping, to be developed quite unequally on different sides of the Nashville dome. For example, the Carters limestone is thickest on the western side, while the overlying Lowville limestone is thickest on the eastern side; the Kimmswick limestone outcrops only on the southern flank; and the next younger formation, the Curdsville limestone, is found alone on the northern side. The chief reason for these differences is believed to be due to oscillation of the Nashville dome, and the great development of phosphatic rock in the Hermitage, Bigby, Catheys, and Leipers formations is considered as likewise connected with the same phenomenon.

David G. Thompson: *Some features of desert playas.* (Illustrated.) The Spanish word playa is used to-day in Spanish-American countries to designate beaches along lakes, seas, or large rivers. Most English-speaking geologists, however, use the term to designate nearly level areas of alluvium in the lowest parts of closed basins in arid or semi-arid regions, which at times may be covered with temporary lakes and which are generally devoid of vegetation. This paper is based on observations of some 30 playas in the Mohave Desert region, California.

Most playas can be separated into two groups, depending upon the position of the water table. In water-tight basins the water table will always be within a few feet of the surface, and ground water is carried upward by capillary movement and discharged by evaporation and transpiration. The playas in these basins are kept moist almost continually by the capillary discharge, and, lacking a better term, they are tentatively called wet playas. If part of the rim of the basin is not water tight, ground water may move freely from one basin to another, and in the higher basin the water table may lie at a considerable depth. Playas in such basins are moistened only occasionally by storm waters and are dry for most of the time. These playas are tentatively called dry playas.

The dry playa has a water table generally deeper than 8 feet; the surface is hard and smooth in the dry season, with or without mud cracks; and there is generally less than 2 per cent of alkali in the soil. The wet playa has a soft, rough, and perennially moist surface; mud

cracks are generally absent; and alkali is present in the soil in amounts over 2 per cent and easily visible. These characteristic features seem to be directly related to the ground-water conditions in the enclosing basins. Observations of these surface features will generally enable the geologists to determine whether or not ground water is close to the surface.

Mechanical analyses were made of a number of samples, and a rough microscopic examination of them was made by Dr. M. I. Goldman to determine whether the soil of playas of the wet type contained more sand than those of the dry type, as seemed to be true in the field. The results did not show any unusual abundance of sand in the soils from the wet playas. The samples from several wet playas, however, showed unusually high percentages of very fine clay. In three samples from dry playas the greater proportion of the fine material was between 0.02 and 0.005 mm. in diameter. In four samples where the water table is known to be or is believed to be close to the surface a very large proportion of the material was much finer, in two of the soils 45 and 66 per cent, respectively, of the entire sample being finer than 0.0005 mm. It is suggested that the greater percentage of very fine material in the soils from the wet playas may be due to more effective chemical decomposition than where the water table is at some distance below the surface. Possibly some of the concentration of clayey material of the dry playa in the larger size is due to the fact that aggregates of the finer material have not been properly dispersed. (*Author's abstract.*)

372D MEETING

The 372d meeting was held in the Cosmos Club, Wednesday evening, April 26, 1922, President ALDEN presiding and 46 persons present.

Program: F. E. MATTHES: *The production of steps in canyons by selective glacial quarrying.* (Illustrated.) A critical study of the features of the Yosemite Valley, the Evolution Valley, and other glaciated canyons in the Sierra Nevada discloses the fact that the cross cliffs in their stairwise ascending floors consist, as a rule, of sparsely jointed, prevailingly massive rocks, whereas the basined treads are developed in relatively well jointed rocks.

The intimate relations that thus are seen to exist between form and structure can scarcely be explained by any of the more generally current theories of glacial excavating. The two theories that have been applied to the interpretation of the development of the Yosemite Valley—the frost sapping theory of Willard D. Johnson and the gravitational corrasion theory of E. C. Andrews—both postulate rapid headward recession of cross cliffs under the influence of sapping processes acting intensively at their bases. The treads of the stairway are supposed to result from this recession, which, for reasons not adequately explained, is assumed to work horizontally, or nearly so. However, it is manifest that the cross cliffs in the Sierra canyons are developed under structural controls of a purely local nature, and therefore are not migrant but essentially stationary features.

It is believed that the evolution of steps in glaciated canyons is better explained by a theory of *selective quarrying*, according to which the ice would excavate most effectively where the rock is most thoroughly jointed and therefore most readily quarried away block

by block, and would excavate least effectively where the rock is massive and not susceptible of being quarried. In a canyon floor composed of alternating stretches of jointed and massive rock, therefore, selective quarrying would in time produce a series of shallow basins separated by barriers of massive rock. However, the barriers are slowly planed down by grinding on their upstream sides and crests, and the basins are quarried out most energetically at their heads, where the glacier falls into them, and so, the asymmetry of both barriers and basins becomes progressively accentuated, and there results a canyon profile resembling a stairway with basined treads.

Abundant proof of the local origin and essentially stationary character of the cross cliffs is afforded by their peculiarities of form, declivity, and orientation, which are in every case clearly determined by the structural peculiarities of the rock. Particularly instructive in this regard are the cross cliffs at the heads of the Yosemite and Evolution valleys. They cut obliquely across the valleys, regardless of the direction of the motion of the ice, but strictly in accordance with the local structures.

ARTHUR HOLLICK: *A review of the fossil flora of the West Indies.* Comparatively little is known and still less has been recorded in relation to the fossil flora of the West Indies. The bibliography is very scanty. Ward,[2] in his comprehensive paper on *The geographical distribution of fossil plants*, issued in 1889, gives a list of eight titles, and states that "the only one of the West Indies from which fossil plants have been reported is the island of Antigua." A recent thorough search through all the available literature on the natural features of the region has resulted in the compilation of a list of only sixteen titles in which there were any descriptions of or references to fossil plants, and many of these include mere incidental references to the presence of fossil plant remains without any descriptive text or illustrations. The only islands in connection with which fossil plants are mentioned are Cuba, Jamaica, Haiti, Porto Rico, Antigua, Martinique, and Trinidad. Collections made within the past three or four years are being studied, and the publication of the results will add considerably to the meagre information heretofore available. All of the specimens included in the several collections mentioned have been figured, and many of the descriptions have been written. It is expected that a contribution will be ready for publication in the near future which will include all that is known at date in regard to the fossil flora of the entire West Indies. (*Author's abstract.*)

WENDELL P. WOODRING: *Tectonic features of the Republic of Haiti and their bearing on the geologic history of the West Indies.* The West Indian region belongs to the zone of Alpine folding that outlines the track of the late Mesozoic and Tertiary equatorial geosyncline. In the Republic of Haiti there were three periods of folding, at the close of Cretaceous time, at the close of Eocene time, and at the close of Miocene time. The geographic and tectonic features of the entire central part of the Republic, of the northwestern peninsula, and in part of the southern peninsula are due to the folding and crumpling of the rocks at the close of Miocene time. In some parts of the Republic the folding that began at the close of Miocene time has con-

[2] Ward, L. F., U. S. Geol. Surv. 8th. Ann. Rep. 1886-87: 663-690. 1889.

tinued to the present time. In these regions Pleistocene reef caps are symmetrically arched over the crests of older arches. In the northwestern peninsula the Pleistocene reef caps have an altitude of 400 to 450 meters above sea level on the crest of the arch.

The most striking feature of the present morphology of the West Indies is the series of arcs, which are convex northward and southward. The great submerged troughs, such as the Bartlett trough, Brownson trough, and Anegada trough, have been interpreted by Vaughan and Taber as down-faulted blocks bounded by normal faults. Accumulating evidence shows that these submerged troughs were deepened, if not formed, at the close of Miocene time and during Pliocene time. It would be difficult to account for the tension demanded by the block-fault hypothesis at any time, but it would be particularly difficult to account for it at the same time when similar subaerial features were being formed in the Republic of Haiti by the folding and crumpling of the rocks. The Cul-de-Sac plain, Artibonite valley, and Central plain are deep subaerial troughs. All of these subaerial troughs are synclines and some of them are bounded by a zone of imbricate high-angle thrust faults. It seems more reasonable to believe that the submerged troughs are similar tectonic features. (*Author's abstract.*)

KIRK BRYAN, *Secretary.*

THE BIOLOGICAL SOCIETY

656TH MEETING

The 656th meeting was held in the lecture hall of the Cosmos Club November 10, 1923, at 8 p.m., with Vice-President Gidley in the chair and 103 persons present. The program was as follows:

W. B. GREELEY. Chief, U. S. Forest Service: *The relation of National Forest management to wild life.*—The National Forests include a large part of the breeding grounds and range of American big game. A game census by Forest officers, though it has obvious limitations, gives a fair idea of the importance of this resource in its total of over 515,000 of the larger ruminants. No management of these areas is sound or far-sighted which does not recognize wild life as one of their major resources, to be fostered and wisely used exactly as timber and forage. The Forest Service is working toward an ultimate policy of real game management, whose main points are: replenishment or restocking of areas depleted of game; maintenance of a normal game population; rational methods of utilizing the natural increase of a normal game stock; total protection of rare or distinctive game animals; complete protection of wild life, except predatory species, on special areas.

The next step in advancing the interests of game as a primary resource of the National Forests should be the enactment of a general law authorizing the establishment of game and fish refuges by Executive Order, with State concurrence. (*Author's abstract.*)

L. O. HOWARD, Chief, Bureau of Entomology: *A recent visit to certain European centers.* The speaker described his visit to Europe during the past year and showed views of the buildings and some of the principal workers at the following institutions: the Liverpool School of Tropical Medicine, the London School of Tropical Medicine, and the Wellcome Research Labora-

tory. The buildings at Hyères, maintained as a laboratory for work on insect parasites by the U. S. Department of Agriculture were also shown. An interesting account was given of Dr. Howard's visit to Dr. Grassi, the Italian worker on malaria, at Fumacino. The talk closed with pictures of the delegates to the International Conference of Phytopathologists and Economic Entomologists at Wageningen.

657TH MEETING

The 657th meeting was held at the Cosmos Club November 24, 1923, at 8 p.m., with Vice-President Oberholser in the chair and 44 persons present. The following persons were elected members of the Society: Edward Elliott, Mrs. Edward Elliott, Harry Harris, A. G. Johnson.

Under *Short Notes*, E. A. GOLDMAN reported his observation of a California Condor at the west entrance of General Grant National Park, Tulare County, Calif., October 11, 1923.

L. O. HOWARD spoke of an interesting lecture on metallic colors recently given at Ithaca by Prof. WILDER BANCROFT.

F. C. LINCOLN reported that 500 returns of banded birds have been received up to October 1. Among the most interesting records are those of three Pintails banded in the Mississippi Valley and recovered in California, and of a Green-winged Teal banded in Louisiana and recovered in California.

The regular program was as follows:

C. W. STILES, Public Health Service: *Underground movements of bacteria.*

The investigations on which this paper is based have been reported on in Public Health Reports **38**:1350–1353. 1923, from which the following abstract is derived:

The pollution of the ground-water (or phreatic water) by privy wastes, and the possibility and method of extension of this pollution to wells, springs, and other water supplies, have been subjects of discussion, experiment, and public health legislation for many years and in various parts of the world. In connection with investigations by the United States Public Health Service, extensive and rigorously controlled experiments have been made which bear upon the subject at issue and especially upon the movement of bacteria, of fecal origin, in the ground-water. These studies have involved the experimental pollution of the ground-water (namely, the water in the saturated zone, which supplies wells and springs), and have been correlated with the rise and fall of the ground-water table, the flow of ground-water, and the rainfall. *Bacillus coli* was taken as the bacterial test, and a dye (uranin) was utilized in tracing the movement of the water from the dosing trenches to the more than 400 experimental pipe wells which were arranged at intervals from the trenches and at various depths into ground-water.

The examination of thousands of water samples from the wells during a period of more than a year has resulted in very definite data which seem to express practically a natural law as applied to the movement of the bacteria in the field of fine sand in which the experiments were conducted. The results to date may be summarized as follows:

1. Pollution with fecal *Bacillus coli* has up to date been definitely and progressively followed in the ground-water for distances of 3 to 65 feet from the trench in which the pollution was placed; uranin has been recovered from these same wells and has spread to other wells at 70 to 117 feet from the

pollution trench. The soil in question is a fine sand with an effective size of 0.13 mm. 2. The pollution has traveled these distances within a period of 187 days, and only in the direction of the flow of the ground-water. 3. The pollution has traveled only in a thin sheet at the surface of the zone of saturation. 4. As the ground-water level falls, owing to dry weather, the pollution tends to remain in the sand above the new (lower) ground-water level, namely, in the new capillary fringe. 5. There is no evidence which would justify a conclusion at present that either the bacteria or the uranin is carried or moves to any appreciable distance in the capillary fringe itself. All present evidence is to the effect that when the ground-water level falls the pollution remains practically stranded in the capillary fringe or in the intermediate belt, according to the degree of fall of the ground-water. 6. A rainfall of 1 inch results in a rise of 5 to 6 inches in the ground-water table (in the particular experimental area in question); and if this rise is sufficient to reestablish the zone of saturation up at the level of the stranded pollution, the bacteria and the uranin are again picked up and carried along farther in the direction of the ground-water flow until dry weather again intervenes to cause another fall of the ground-water level. 7. Thus the progressive (passive) movement and the stasis (stranding) of the pollution are intimately connected with, are dependent upon, and alternate with the rise and the fall of the ground-water level, and this latter factor is dependent upon the alternation of wet weather and dry weather. 8. In explaining these results, capillarity, filtration, and gravity seem to come up for special consideration. 9. The ultimate distance to which the pollution will be carried is dependent upon a number of complex and interlocking factors, namely, wet and dry weather, with resulting rise and fall of the ground-water; the length of each of these periods; the rate of the ground-water flow (depending upon the "head," which, in turn, is dependent upon the rainfall); and, obviously, also the factor of the viability of the organisms under conditions of moisture, pH, food supply, etc. 10. The bearing of the foregoing results upon the intermittent pollution of wells, the location of water supplies, and the location of camps in peace or in war, will be evident to persons who are called upon for technical advice in these matters. 11. In protecting wells special attention should be given not only to surface protection as is now generally recognized but also to a new element, namely, the danger zone which exists from the highest water level to about a foot below the lowest water level. A leak in the pipe in this region is potentially very dangerous, and all wells unprotected in this danger zone are to be considered as potentially unsafe.

This paper was discussed by Messrs. BOND, GOLDMAN, and BAILEY.

FRANK BOND, General Land Office: *Reproduction in painting of the metallic feathers of birds, with exhibition of paintings of hummingbirds.*

About fourteen years ago the speaker saw in the possession of W. L. Baily, of Ardmore, Pennsylvania, a book containing paintings of hummingbirds made by Mr. Baily's uncle fifty or sixty years before. The effort of this painter to reproduce in pictures the iridescence of the throat feathers of hummingbirds aroused the interest of the speaker, and urged him to make experiments with a view to reviving what was believed to be a lost art. After many months' effort he succeeded in painting pictures in which the luster of the feathers was brilliantly reproduced, as follows:

By means of a process which usually employs gold or silver leaf in order to secure a brilliant reflecting surface, which is the necessary first step, thereafter followed with successive applications on the reflecting surface of

a protecting transparent medium, a transparent paste colored with such transparent or lantern slide colors as many be required, and thereafter tracing with transparent or opaque colors feather designs to reproduce characteristic plumage details with the luster desired, he has succeeded in representing with remarkable fidelity the sheen of the hummingbird's plumage.

The collection of paintings exhibited by Mr. Bond represented the male of every United States species of hummingbird, except one, and of that no adult male has yet been collected.

In discussing the paper Dr. T. S. PALMER mentioned that the Mr. Baily, by whom the earlier paintings were made, had been in correspondence with John Gould, the celebrated British ornithologist, at the time of publication of Gould's monograph on the Trochilidae, and had in fact offered to communicate to Gould his secrets of painting,—an offer which was not accepted by Gould. The process invented by Mr. Bond has been patented, and may prove to be of commercial importance. (*Author's abstract.*)

658TH MEETING

The 658th regular and 44th annual meeting of the Biological Society was held at the Cosmos Club December 8, 1923 at 8:15 p.m., with Vice-President E. A. Goldman in the chair and 16 persons present. The minutes of the previous annual meeting were read and approved.

The reports of the Recording Secretary, the Corresponding Secretary, the Committee on Publications, and the Treasurer were read and accepted.

The following officers were elected: President, J. W. Gidley; Vice-Presidents, S. A. Rohwer, H. C. Oberholser, E. A. Goldman, A. Wetmore; Recording Secretary, S. F. Blake; Corresponding Secretary, T. E. Snyder; Treasurer, F. C. Lincoln; Members of the Council, C. E. Chambliss, H. C. Fuller, H. H. T. Jackson, W. R. Maxon, C. W. Stiles.

S. F. BLAKE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

The sixteenth annual meeting of the American Institute of Chemical Engineers was held in Washington December 5–7, 1923.

At the meeting of the Petrologists' Club on Tuesday, December 4, 1923, the program was given by E. B. SAMPSON, who spoke on *Determination of anisotropy in metallic minerals*, and E. V. SHANNON, on *Mineralogy and petrography of intrusive Triassic diabase at Goose Creek, Virginia.*

Dr. ARTHUR L. DAY, director of the Geophysical Laboratory, Carnegie Institution of Washington, gave the inaugural lecture of the 1923 series before the members of the Royal Canadian Institute in Toronto, November 17. His subject was *Earthquakes and volcanic eruptions.*